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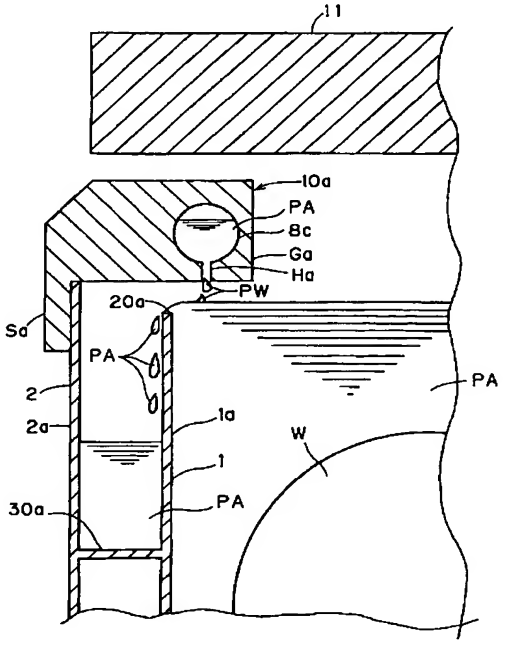
(54)【発明の名称】　基板処理装置

(57)【要約】

【課題】　補充液の突沸が起こらず、なおかつ補充液が処理液中へ十分に拡散するとともに処理液の温度低下が少ない基板処理装置を提供する。

【解決手段】　純水ＰＷは純水注入ノズル１０ａの複数の純水吹出し口Ｈａから排出され、その直下の内槽１の内側で内槽１の側面１ａの上端である溢流部２０ａ近傍の燐酸溶液ＰＡの表面に至り、燐酸溶液ＰＡと混ざりながら外槽２の樋部３０ａに至り、外槽２の貯留部３０ｄに流れ込む。したがって、純水ＰＷが内槽１内の燐酸溶液ＰＡ内部に至ることがないため純水ＰＷの突沸が起こらず、かつ燐酸溶液ＰＡが内槽１から外槽２に溢流する際に燐酸溶液ＰＡと純水ＰＷが撹拌されるため純水ＰＷが燐酸溶液ＰＡ中へ十分に拡散し、さらに燐酸溶液ＰＡ表面から直接水分が蒸発することがないので燐酸溶液ＰＡの温度低下が少ない。



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【特許請求の範囲】

【請求項１】　複数種の液を組み合わせてなる処理液を処理槽に貯留し、前記処理液の温度を前記複数種の液のうちの少なくとも一種の液の沸点以上に加熱して、前記処理液中に被処理基板を浸漬する基板処理装置において、

前記処理液を貯留し、上端が前記処理液の溢れ出る溢流部とされた内槽と、

前記内槽の前記溢流部から溢れ出た前記処理液を受ける外槽と、

前記外槽で受けた前記処理液を前記内槽に循環させる処理液循環手段と、

前記複数種の液のうち、前記処理液の温度以下の沸点を持つ液を補充液として前記内槽において前記溢流部直上または溢流部近傍に供給する補充液供給手段と、

を備えたことを特徴とする基板処理装置。

【請求項２】　請求項１の基板処理装置において、

前記複数種の液のうちの前記処理液の温度より高い沸点を持つ液のうちの一種が燐酸であり、前記補充液が純水であることを特徴とする基板処理装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、半導体基板や液晶ガラス基板等の基板を処理液に浸漬して表面処理を行う装置に関し、特に、複数種の液を組み合わせた処理液を処理槽に貯留し、処理液の温度を処理液を構成する複数種の液の中の少なくとも一種の液の沸点以上に加熱して、処理液中に基板を浸漬する基板処理装置に関する。

【０００２】

【従来の技術】例えば半導体基板表面のシリコン窒化膜を、高温度の燐酸（H_3PO_4）溶液を用いてエッチング処理する際には、燐酸溶液の温度のみならずその濃度が変動すると、エッチング・レートが変化して均一な処理結果が得られない。そのため、燐酸溶液の温度および濃度を許容範囲に維持する必要がある。

【０００３】ところが、このようなエッチング処理においては燐酸溶液を１５０℃～１８０℃程度の高温に保たなければならないため、溶液中の水分が蒸発しやすく、それに伴って燐酸溶液の濃度が上昇してしまい、前述のようなエッチング・レートの変化による処理結果の不均一が生じてしまう。

【０００４】そのため、従来は主に以下のような４種類の方法によってエッチング処理の際に純水を燐酸溶液に適宜補充していた。

【０００５】１．実開平２－９８６３１号公報に示されているように、燐酸溶液を収容した処理槽内の下部に、多数の微細な通孔が開けられた壁体を有するノズルを配し、該ノズルを通じて燐酸溶液中に純水を補充する方法。

【０００６】２．特公平３－２０８９５号公報に示されているように、処理槽内の燐酸溶液を処理槽外に導き出して温調、フィルタリングし、再び該燐酸溶液を処理槽内に戻すことで燐酸溶液を循環させる循環ライン中に純水を補充する方法。

【０００７】３．実開昭５９－８４８３９号公報に示されているように、処理槽の底部の穴から純水を補充する方法。

【０００８】４．特開平６－６９１７９号公報に示されているように、エッチング処理を行う内槽の外側に外槽を設けた二重槽として、内槽から外槽に常時燐酸溶液を溢れさせて、その燐酸溶液が貯留する外槽に上方から純水を注入し、その純水を含んだ燐酸溶液を内槽に循環させる方法。

【０００９】

【発明が解決しようとする課題】ところで、上記のような純水の補充方法において、１，２および３の方法では純水を燐酸溶液中に注入する構成としているため、燐酸溶液に注入された純水が注入直後に燐酸溶液中において急激に沸騰するといった突沸を起こすことがあった。

【００１０】また、４の方法では純水を外槽に貯留した燐酸溶液の表面に注入する構成としているため燐酸溶液の表面で純水が留まってしまい、燐酸溶液中への拡散が起こりにくいとともに、燐酸溶液表面から純水が蒸発するために気化熱による燐酸溶液の温度低下が著しかった。

【００１１】この発明は、従来技術における上述の問題の克服を意図しており、補充液の突沸が起こらず、なおかつ補充液が処理液中へ十分に拡散するとともに処理液の温度低下が少ない基板処理装置を提供することを目的とする。

【００１２】

【課題を解決するための手段】上記の目的を達成するため、この発明の請求項１の装置は、複数種の液を組み合わせてなる処理液を処理槽に貯留し、前記処理液の温度を前記複数種の液のうちの少なくとも一種の液の沸点以上に加熱して、前記処理液中に被処理基板を浸漬する基板処理装置であって、前記処理液を貯留し、上端が前記処理液の溢れ出る溢流部とされた内槽と、前記内槽の前記溢流部から溢れ出た前記処理液を受ける外槽と、前記外槽で受けた前記処理液を前記内槽に循環させる処理液循環手段と、前記複数種の液のうち、前記処理液の温度以下の沸点を持つ液を補充液として前記内槽において前記溢流部直上または溢流部近傍に供給する補充液供給手段と、を備える。

【００１３】また、この発明の請求項２の装置は、請求項１の基板処理装置において、前記複数種の液のうちの前記処理液の温度より高い沸点を持つ液のうちの一種が燐酸であり、前記補充液が純水であることを特徴とする。

【００１４】

【発明の実施の形態】

【００１５】

【１．実施の形態における機構的構成と装置配列】図１はこの実施の形態の基板処理装置の外観の斜視図である。また、図２は実施の形態の基板処理装置の概略説明図である。図１では床面に平行な水平面をＸ－Ｙ面とし、鉛直方向をＺ方向とする３次元座標系Ｘ－Ｙ－Ｚが定義されている。

【００１６】以下、これらの図を用いてこの実施の形態の基板処理装置の機構的構成を説明していく。

【００１７】この基板処理装置は半導体基板上のシリコン窒化膜を、高温度の燐酸溶液を用いてエッチング処理する装置である。この装置は内槽１および外槽２からなる処理槽３０を備えており、内槽１は上方が解放された筐体からなっており、内部に１５０℃～１８０℃の燐酸溶液ＰＡを貯留し、基板Ｗが他の処理部から搬送された後にこの内槽１内の燐酸溶液ＰＡに浸漬され、エッチング処理が施される。

【００１８】この内槽１の外側には内槽１を内包するように、上方が解放された筐体状の外槽２が固設されており、内槽１の側面上部から外槽２に溢流する燐酸溶液ＰＡを受ける。

【００１９】また外槽２の内側には配管３ａが外槽２のＸ方向の正側の側面２ｄを貫通するように固設され、さらに外槽２内部において配管３ａの一端は外槽２の底部近傍に位置している。そして、図１には示されていないが図２に示すように配管３ａの他端は外槽２の外部において循環ポンプ４に接続され、また、循環ポンプ４は配管３ｂを介してヒータ５に接続され、そして、ヒータ５は配管３ｃを介してフィルタ６に接続されている。さらに、フィルタ６に接続された配管３ｄは外槽２の側面２ｄを配管３ａより上方において貫通し、外槽２内において内槽１のＸの正側の側面を貫通するように固設され内槽１内部において図２に示す燐酸溶液吹出し管１２に接続されている。

【００２０】一方、図２に示す純水槽７には配管８ａの一端が接続され、配管８ａの他端には純水ＰＷを予め設定された流量で圧送する定量ポンプ９が接続されている。さらに定量ポンプ９には配管８ｂの一端が接続されており、配管８ｂの他端は二又に分かれて配管８ｃおよび８ｄに接続され、一方の配管８ｃは純水注入ノズル１０ａに接続され、他方の配管８ｄは純水注入ノズル１０ｂに接続されている。

【００２１】また、純水注入ノズル１０ａは内槽１のＹ方向の正側の側面１ａの上端である溢流部２０ａの上方近傍に、純水注入ノズル１０ｂは内槽１のＹ方向の負側の側面１ｃの上端である溢流部２０ｂの上方近傍に設けられている。

【００２２】さらに、純水注入ノズル１０ａ，１０ｂの上方にはエッチング処理時の燐酸溶液ＰＡの飛沫が周囲に至らないように、図示しないフレームに係止され、基板Ｗの搬入および搬出時のみ開くとともに、それ以外は閉じられるオートカバー１１（１１ａ，１１ｂ）が設けられている。

【００２３】つぎに、以下において要部の詳細な構成について説明していく。

【００２４】図１に示すように、内槽１および外槽２の四方の側面はそれぞれ同一の高さに形成されており、さらに内槽１の高さは外槽２の高さよりわずかに低く形成されている。そして、外槽２と内槽１の間は内槽１の側面１ａと外槽２のＹ方向の正側の側面２ａとの間は深さが浅くなった樋部３０ａが形成されており、同様に、内槽１のＸ方向の負側の側面１ｂと外槽２のＸ方向の負側の側面２ｂの間に樋部３０ｂ、内槽１の側面１ｃと外槽２のＹ方向の負側の側面２ｃとの間に樋部３０ｃが形成されている。さらに、内槽１のＸ方向の正側の側面１ｄと外槽２のＸ方向の正側の側面２ｄとの間は深くなっており、貯留部３０ｄが形成されている。

【００２５】図３はこの実施の形態の基板処理装置の純水注入ノズル１０ａ周辺の部分断面図である。純水注入ノズル１０ａはその支持部Ｓａが外槽２の側面２ａの外側の上部に固設されており、さらに張出し部Ｇａが内槽１の側面１ａの内側まで張り出しており、その張出し部Ｇａの下面は内槽１の側面１ａの上端である溢流部２０ａの上方近傍に位置している。純水注入ノズル１０ａの内部には配管８ｃが挿通されており、図１に示す配管８ｃの内槽１の上方部分である吹出し位置Ｕａの下面側には図３に示すように燐酸溶液ＰＡを供給する複数の純水吹出し口Ｈａが図１のＸ軸方向に等間隔に設けられている。

【００２６】なお、純水注入ノズル１０ｂも同様に支持部Ｓｂ（図１参照）が外槽２の側面２ｃの外側上部に固設され、張出し部Ｇｂの下面が内槽１の側面１ｃの上端である溢流部２０ｂの上方近傍に位置しており、純水注入ノズル１０ｂの内部の配管８ｄの内槽１の上方部分である吹出し位置Ｕｂの下面側には複数の純水吹出し口Ｈｂが X軸の正方向に等間隔に設けられている。

【００２７】

【２．実施の形態における特徴および処理】以下において、この実施の形態の基板処理装置の処理全般および特徴を説明していく。

【００２８】基板Ｗのエッチング処理時、内槽１においてはその四方の側面の上端から燐酸溶液ＰＡをオーバーフローさせている。

【００２９】そして、内槽１から外槽２にオーバーフローした燐酸溶液ＰＡは常時配管３ａを通じて循環ポンプ４により外槽２から排出され、配管３ｂを通じてヒータ５に送給され、そこで液温を１５０～１８０℃に維持するように加熱される。さらにヒータ５を通った燐酸溶液ＰＡは配管３ｃを経てフィルタ６に送給され、そこで不

純物等を除去された後、配管３ｄを経て内槽１に戻され、ふたたび基板Ｗのエッチング処理に使用される。このようにこの実施の形態の基板処理装置では燐酸溶液ＰＡを循環させて使用している。

【００３０】また、上記のように燐酸溶液ＰＡは液温が１５０～１８０℃に維持されていることにより、その内部に含まれる水分は蒸発しやすく、それにより燐酸溶液ＰＡの濃度が変化しやすい。そこで、この装置では純水ＰＷの蒸発にともなう燐酸溶液ＰＡの濃度の変化をオペレータが計測器等により測定し、その測定値から純水ＰＷの単位時間当たりの蒸発量を求め、それに基づいて定量ポンプ９の流量を設定することにより、純水槽７から適当な量の純水ＰＷを純水注入ノズル１０ａ，１０ｂに送給する。

【００３１】そして、図３に示すように、純水注入ノズル１０ａ，１０ｂに供給された純水ＰＷは純水注入ノズル１０ａ，１０ｂのそれぞれの複数の純水吹出し口Ｈａ，Ｈｂから排出され、その直下の内槽１の内側で内槽１の側面１ａおよび１ｃのそれぞれの上端である溢流部２０ａおよび２０ｂ近傍の燐酸溶液ＰＡの表面に至り、燐酸溶液ＰＡに混ざり合いながら外槽２の樋部３０ａおよび３０ｃに至り、外槽２の貯留部３０ｄに流れ込む。

【００３２】そして、外槽２の貯留部３０ｄに貯留された燐酸溶液ＰＡは、上記のように配管３ａ～３ｄ、循環ポンプ４、ヒータ５、フィルタ６を経由して内槽１に戻され、ふたたび基板Ｗのエッチング処理に使用される。

【００３３】このように、この実施の形態の基板処理装置では燐酸溶液ＰＡの溢流部である内槽１の側面１ａおよび１ｃのそれぞれの上端である溢流部２０ａおよび２０ｂの近傍に純水ＰＷを供給する構成としたため、純水ＰＷが内槽１内の燐酸溶液ＰＡ内部に至ることがない。そのため純水ＰＷの突沸が起こらず、なおかつ燐酸溶液ＰＡが内槽１から外槽２に溢流する際に燐酸溶液ＰＡと純水ＰＷが撹拌されるため純水ＰＷが処理液中へ十分に拡散し、それにより純水ＰＷが燐酸溶液ＰＡ表面に留まって燐酸溶液ＰＡ表面から直接空気中に蒸発することがないので燐酸溶液ＰＡの温度低下が少ない。

【００３４】

【３．変形例】本発明の実施の形態の基板処理装置では、処理液を構成する複数種の液のうちの処理液の温度より高い沸点を持つ液を燐酸液、補充液を純水とする構成としたが、処理液を構成する複数種の液はこれらに限定されるものではなく、たとえば、硫酸液と過酸化水素水を組み合わせて処理液を構成してもよく、この場合には処理液の温度を過酸化水素水の沸点より高温の１３０℃程度に加熱するため、処理液の温度より高い沸点を持つ液を硫酸液、補充液を純水とする構成である。

【００３５】また、この実施の形態の基板処理装置では補充液を純水一種のみとしたが、処理液の温度以下の沸点を持つ複数種の液を補充液とすることも可能である。

【００３６】また、この実施の形態の基板処理装置では純水注入ノズル内の配管に複数の純水吹出し口を等間隔に設ける構成としたが、必ずしも等間隔でなくてもよく、純水吹出し口を単数とすることもできる。さらに、純水を供給する手段はこれに限定されるものではなく、たとえば、スリット状の開孔を設ける等の構成としてもよい。

【００３７】また、この実施の形態の基板処理装置では燐酸溶液の濃度の変化をオペレータが計測器等により測定し、その測定値から純水の単位時間当たりの蒸発量を求め、それに基づいて定量ポンプによる純水の補充量を設定する構成としたが、燐酸溶液の濃度をセンサ等で時系列的に捉え、そのデータを基に流量制御型のポンプを制御装置で制御することにより純水の補充量を調節する構成としてもよい。

【００３８】また、この実施の形態の基板処理装置では、内槽１はその四方の側面の上端の高さを同じにして燐酸溶液が四方から外槽に溢れる構成としたが、本発明は必ずしも四方の側面のすべてから溢れる構成に限られるものではなく、たとえば、内槽１の側面１ａおよび１ｃのそれぞれの上端である溢流部２０ａおよび２０ｂをＸ方向の２つの側面より低くして側面１ａ，１ｃからのみ溢れる等の構成としてもよい。

【００３９】さらに、この実施の形態の基板処理装置では純水注入ノズルを２つ設ける構成としたが、内槽の一側面に対してのみ純水注入ノズルを１つ設ける構成や、内槽の四方の側面のそれぞれに対して設ける構成としてもよい。

【００４０】また本発明の実施の形態の基板処理装置では純水注入ノズル１０ａ，１０ｂの純水吹出し口Ｈａ，Ｈｂを溢流部２０ａ，２０ｂの上方近傍に配しているが、前記純水吹出し口Ｈａ，Ｈｂを溢流部２０ａ，２０ｂの直上に配してもよい。

【００４１】

【実施例】なお、この基板処理装置の実施例では純水注入ノズル１０はテフロン（デュポン社の４フッ化エチレン重合体の商標名）製であり、内槽１および外槽２は石英製であり、その他の部材も上記のテフロンやＰＴＰＦ（ポリテトラフロロエチレン）等の耐熱性、耐食性を備える材料を用いて燐酸溶液による熱や、腐蝕に耐えられるように構成されている。

【００４２】さらに、この基板処理装置の実施例では内槽および外槽を併せた処理槽全体の容量を３０～４０リットルとしており、これに対して定量ポンプの流量の設定値を０～２００ｃｃ／ｍｉｎの間で調節可能に構成している。このように、この実施例では燐酸溶液の量に対する水分の蒸発量に応じた純水供給量の調節ができる。

【００４３】

【発明の効果】以上説明したように、請求項１および請求項２の発明では処理液を構成する複数種の液のうち、

処理液の温度以下の沸点を持つ液を補充液として内槽の処理液が溢れ出る溢流部直上または溢流部近傍に供給する構成としたため、補充液が内槽内の処理液の内部に至ることがないため補充液の突沸が起こらず、なおかつ処理液が内槽から外槽に溢流する際に処理液と補充液が撹拌されるため補充液が処理液中へ十分に拡散し、それにより補充液が処理液表面に留まって処理液表面から直接空気中に蒸発することがないので処理液の温度低下が少ない。

【図面の簡単な説明】

【図１】実施の形態の基板処理装置の外観の斜視図である。

【図２】実施の形態の基板処理装置の概略説明図である。

【図３】実施の形態の基板処理装置の部分断面図である。

【符号の説明】

１　内槽

＊２　外槽

３ａ～３ｄ　配管

４　循環ポンプ

５　ヒータ

７　純水槽

８ａ～８ｄ　配管

９　定量ポンプ

１０ａ，１０ｂ　純水注入ノズル

３０　処理槽

３０ａ，３０ｂ，３０ｃ　樋部

Ｈａ，Ｈｂ　純水吹出し口

２０ａ，２０ｂ　溢流部

１ａ，１ｃ　内槽の側面

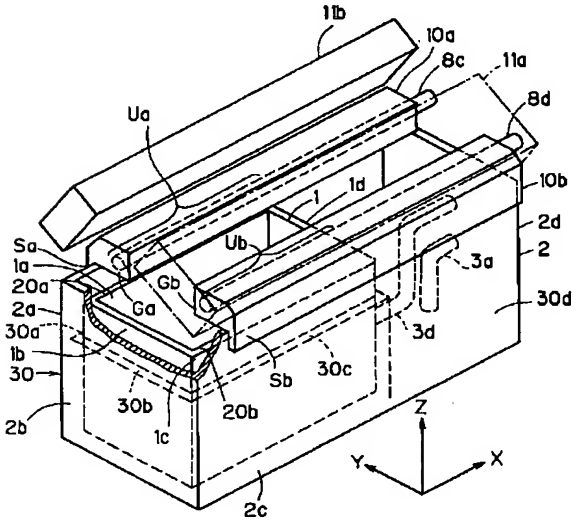
ＰＡ　燐酸溶液

ＰＷ　純水

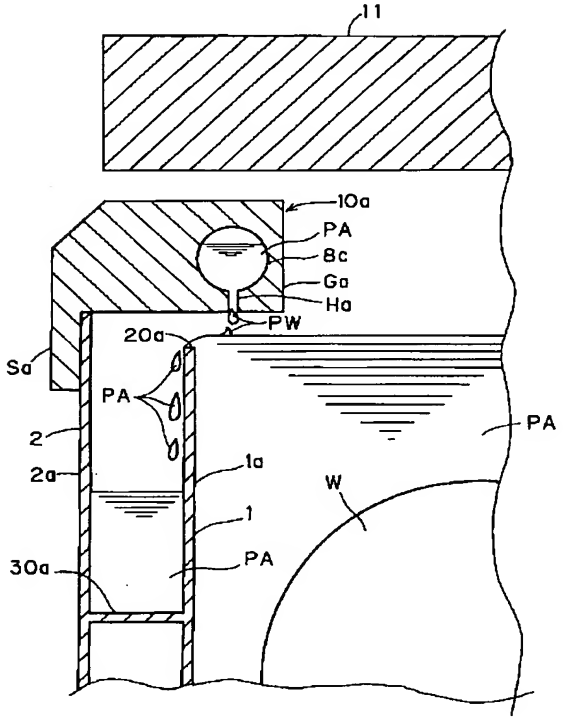
Ｕａ，Ｕｂ　吹出し位置

Ｗ　基板

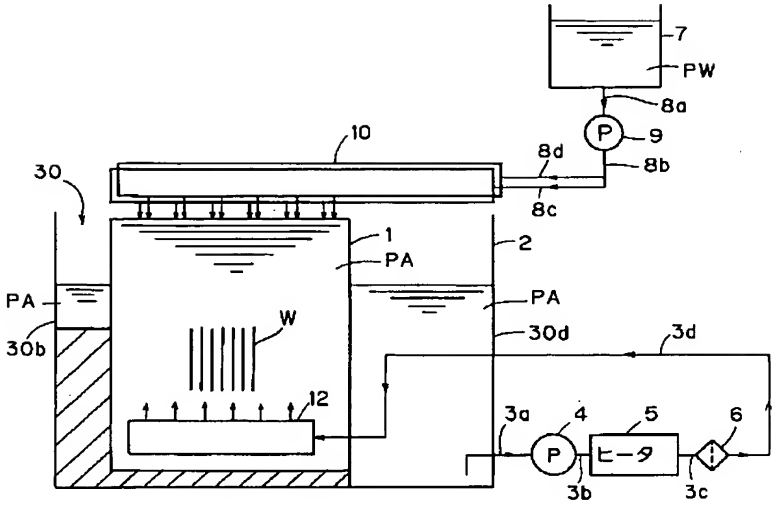
【図１】



【図３】



【図２】



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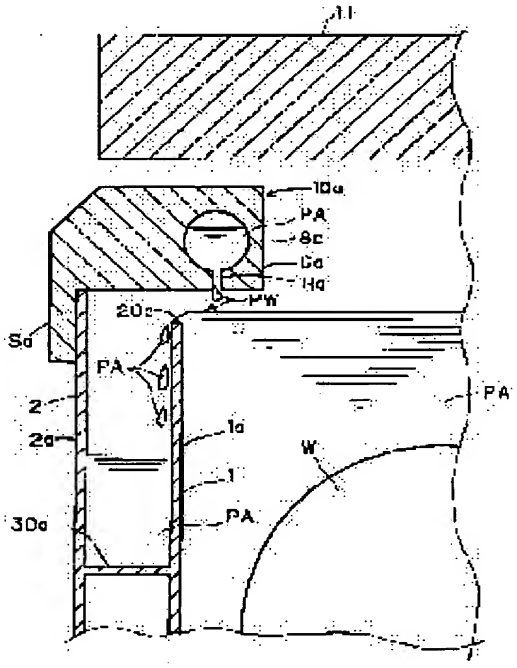
(54) SUBSTRATE TREATING APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a substrate treating apparatus whereby a replenished liquid is diffused enough into a treating liq. with a little liq.'s temp drop, without boiling of the replenished liquid.
SOLUTION: Pure water PW is drainwater from pure water jet holes Ha of a pure water injection nozzle 10a to the surface of a phosphate soln. PA near an overflowing part 20a at the top end of the inner side face 1a of an inner tank 1 disposed beneath the holes Ha, arrives at a gutter of an outer tank 2 during mixing with the soln. PA and flows into a reservoir 30d of the tank 2. Since the water PW never arrives at the interior of the soln. PA in the tank 1, no boiling of the water occurs and when the soln. PA overflows from the tank 1 to the tank 2, both the liq. PA and water PW are stirred to diffuse the water enough in the soln. PA. Since no water evaporates directly from the surface of the soln. PA, its temp. drop is little.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Processing liquid which comes to combine two or more sorts of liquid characterized by providing the following is stored in a processing tub, and it is said substrate processor which heats more than the boiling point of at least a kind of liquid of the liquid of a seed, and is immersed in a processed substrate into said processing liquid two or more about temperature of said processing liquid. An inner lift which stores said processing liquid and by which an upper bed was made the overflow section in which said processing liquid overflows An outside tub which receives said processing liquid which overflowed from said overflow section of said inner lift A processing liquid circulation means to make said inner lift circulate through the carrier beam aforementioned processing liquid by said outside tub A replenisher supply means to supply right above [said / overflow section] or near the overflow section in said inner lift by making into a replenisher said liquid which has two or more boiling points below temperature of said processing liquid among liquid of a seed
[Claim 2] A substrate processor characterized by for a kind of said liquid with two or more boiling points higher than temperature of said processing liquid of the liquid of a seed being phosphoric acid, and said replenisher being pure water in a substrate processor of claim 1.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention stores in a processing tub the processing liquid which combined two or more sorts of liquid especially about the equipment which is immersed in processing liquid in substrates, such as a semiconductor substrate and a liquid-crystal glass substrate, and performs surface treatment, heats the temperature of processing liquid more than the boiling point of at least a kind of liquid in two or more sorts of liquid which constitutes processing liquid, and relates to the substrate processor immersed in a substrate into processing liquid.
[0002]
[Description of the Prior Art] For example, if not only the temperature of a phosphoric acid solution but its concentration is changed in case etching processing of the silicon nitride of a semiconductor substrate front face is carried out using the phosphoric acid (H3P O4) solution of high temperature, an etching rate will change and a uniform processing result will not be obtained. Therefore, it is necessary to maintain the temperature and concentration of a phosphoric acid solution to tolerance.
[0003] However, in order to have to maintain a phosphoric acid solution at a 150 degrees C - about 180 degrees C elevated temperature in such etching processing, the moisture in a solution will tend to evaporate, the concentration of a phosphoric acid solution will rise in connection with it, and the ununiformity of the processing result by change of the above etching rates will arise.
[0004] Therefore, the phosphoric acid solution was conventionally supplemented with pure water suitably by four kinds of mainly following methods on the occasion of etching processing.
[0005] 1. How to allot nozzle which has wall which many detailed through-holes were able to open to the lower part in processing tub which held phosphoric acid solution, and to supplement it with pure water into phosphoric acid solution through this nozzle as shown in JP,2-98631,U.
[0006] 2. How to fill up pure water all over circulation line which phosphoric acid solution in processing tub is drawn [circulation line] out of processing tub, and circulates phosphoric acid solution by ** tone and filtering and returning this phosphoric acid solution in processing tub again as shown in JP,3-20895,B.
[0007] 3. How to fill up pure water from hole of pars basilaris ossis occipitalis of processing tub as shown in JP,59-84839,U.
[0008] 4. How to make inner lift circulate through phosphoric acid solution which phosphoric acid solution was always flooded to outside tub from inner lift, poured pure water into outside tub which the phosphoric acid solution stores from the upper part as duplex tub which prepared outside tub in outside of inner lift which performs etching processing as shown in JP,6-69179,A, and contained the pure water.
[0009]
[Problem(s) to be Solved by the Invention] By the way, in the supplement method of the above pure water, bumping that the pure water poured into the phosphoric acid solution boiled at the method of 1, 2, and 3 rapidly in a phosphoric acid solution immediately after impregnation since it is considering as the configuration which pours in pure water into a phosphoric acid solution

might be caused.
[0010] Moreover, since it was considering as the configuration which injects pure water into the front face of the phosphoric acid solution stored in the outside tub by the method of 4, while pure water stops at the front face of a phosphoric acid solution and diffusion into a phosphoric acid solution could not take place easily, since pure water evaporated from a phosphoric acid solution front face, temperature lowering of the phosphoric acid solution by heat of vaporization was remarkable.
[0011] conquest of an above-mentioned problem [in / in this invention / the conventional technology] -- meaning -- **** -- bumping of a replenisher -- not happening -- in addition -- and while a replenisher fully diffuses into processing liquid, temperature lowering of processing liquid aims at offering few substrate processors.
[0012]
[Means for Solving the Problem] In order to attain the above-mentioned object, equipment of claim 1 of this invention Store in a processing tub processing liquid which comes to combine two or more sorts of liquid, and temperature of said processing liquid is heated more than the boiling point of at least a kind of liquid of said two or more sorts of liquid. An inner lift which is the substrate processor immersed in a processed substrate into said processing liquid, and stores said processing liquid and by which an upper bed was made the overflow section in which said processing liquid overflows, An outside tub which receives said processing liquid which overflowed from said overflow section of said inner lift, and a processing liquid circulation means to make said inner lift circulate through the carrier beam aforementioned processing liquid by said outside tub, It has a replenisher supply means to supply right above [said / overflow section] or near the overflow section in said inner lift by making into a replenisher said liquid which has two or more boiling points below temperature of said processing liquid among liquid of a seed.
[0013] Moreover, in a substrate processor of claim 1, a kind of said liquid with two or more boiling points higher than temperature of said processing liquid of the liquid of a seed is phosphoric acid, and equipment of claim 2 of this invention is characterized by said replenisher being pure water.
[0014]
[Embodiment of the Invention]
[0015]
[The structural configuration and equipment array] in a gestalt of 1. operation Drawing 1 is the perspective diagram of the appearance of the substrate processor of the gestalt of this operation. Moreover, drawing 2 is approximate account drawing of the substrate processor of the gestalt of operation. Three-dimension system-of-coordinates X-Y-Z which makes the level surface parallel to a floor line a X-Y side, and makes the direction of a vertical a Z direction is defined by drawing 1 .
[0016] Hereafter, the structural configuration of the substrate processor of the gestalt of this operation is explained using these drawings.
[0017] This substrate processor is equipment which carries out etching processing of the silicon nitride on a semiconductor substrate using the phosphoric acid solution of high temperature. It consists of a case with which this equipment is equipped with the processing tub 30 which consists of an inner lift 1 and an outside tub 2, and, as for the inner lift 1, the upper part was released, and the 150 degrees C - 180 degrees C phosphoric acid solution PA is stored in the interior, after Substrate W is conveyed from other processing sections, it is immersed in the phosphoric acid solution PA in this inner lift 1, and etching processing is performed.
[0018] The tub 2 is fixed to the outside of this inner lift 1 outside the shape of a case from which the upper part was released so that an inner lift 1 might be connoted, and the phosphoric acid solution PA which carries out overflow to the outside tub 2 is received from the side upper part of an inner lift 1.
[0019] Moreover, inside the outside tub 2, it is fixed so that piping 3a may penetrate 2d of sides by the side of positive [of the direction of X of the outside tub 2], and in the outside tub 2 interior, the end of piping 3a is further located in it near the pars basilaris ossis occipitalis of the

outside tub 2. And although not shown in drawing 1 , as shown in drawing 2 , the other end of piping 3a is connected to a circulating pump 4 in the exterior of the outside tub 2, and a circulating pump 4 is connected to a heater 5 through piping 3b, and the heater 5 is connected to the filter 6 through piping 3c. Furthermore, 3d of piping connected to the filter 6 is connected to the phosphoric acid solution blow-off pipe 12 which is fixed so that 2d of sides of the outside tub 2 may be penetrated in the upper part from piping 3a and the side by the side of positive [of X of an inner lift 1] may be penetrated in the outside tub 2, and is shown in drawing 2 in the inner lift 1 interior.
[0020] On the other hand, the end of piping 8a is connected to the pure water tub 7 shown in drawing 2 , and the metering pump 9 which feeds pure water PW by the flow rate set up beforehand is connected to the other end of piping 8a. Furthermore the end of piping 8b is connected to the metering pump 9, the other end of piping 8b is divided into a branch, and is connected to Piping 8c and 8d, one piping 8c is connected to pure water impregnation nozzle 10a, and 8d of piping of another side is connected to pure water impregnation nozzle 10b.
[0021] Moreover, pure water impregnation nozzle 10b is prepared near the upper part of overflow section 20b which is the upper bed of side 1c of the negative side of the direction of Y of an inner lift 1 near [whose pure water impregnation nozzle 10a is the upper bed of side 1a by the side of positive / of the direction of Y of an inner lift 1] the upper part of overflow section 20a.
[0022] Furthermore, while being stopped by the frame which is not illustrated and opening only at the time of carrying in of Substrate W and taking out so that the droplet of the phosphoric acid solution PA at the time of etching processing may not result above the pure water impregnation nozzles 10a and 10b around, the auto covering 11 (11a, 11b) closed is formed except it.
[0023] The detailed configuration of an important section is explained below.
[0024] As shown in drawing 1 , the side of the four way type of an inner lift 1 and the outside tub 2 is formed in the same height, respectively, and the height of an inner lift 1 is further formed low slightly from the height of the outside tub 2. And gutter 30a to which the depth became shallow between side 1a of an inner lift 1 and side 2a by the side of positive [of the direction of Y of the outside tub 2] is formed between the outside tub 2 and the inner lift 1. Similarly, gutter 30c is formed between gutter 30b, side 1c of an inner lift 1, and side 2c of the negative side of the direction of Y of the outside tub 2 between side 1b of the negative side of the direction of X of an inner lift 1, and side 2b of the negative side of the direction of X of the outside tub 2. Furthermore, it is deep between 1d of sides by the side of positive [of the direction of X of an inner lift 1], and 2d of sides by the side of positive [of the direction of X of the outside tub 2], and 30d of reservoir sections is formed.
[0025] Drawing 3 is the fragmentary sectional view of the pure water impregnation nozzle 10a circumference of the substrate processor of the gestalt of this operation. The supporter Sa is fixed to the upper part of the outside of side 2a of the outside tub 2, the overhang section Ga has jutted out pure water impregnation nozzle 10a to the inside of side 1a of an inner lift 1 further, and the underside of the overhang section Ga is located near the upper part of overflow section 20a which is the upper bed of side 1a of an inner lift 1. Piping 8c is inserted in the interior of pure water impregnation nozzle 10a, and two or more pure water exit cones Ha which supply the phosphoric acid solution PA to the underside side of the blow-off location Ua which is the upper part portion of the inner lift 1 of piping 8c shown in drawing 1 as shown in drawing 3 are formed in X shaft orientations of drawing 1 at equal intervals.
[0026] In addition, Supporter Sb (refer to drawing 1) is similarly fixed to the outside upper part of side 2c of the outside tub 2 for pure water impregnation nozzle 10b. It is located near [whose underside of the overhang section Gb is the upper bed of side 1c of an inner lift 1] the upper part of overflow section 20b, and two or more pure water exit-cone Hb is prepared in the positive direction of the X-axis at equal intervals at the underside side of the blow-off location Ub which is the upper part portion of an inner lift 1 of 8d of piping inside pure water impregnation nozzle 10b.
[0027]
[The feature and processing] in the gestalt of 2. operation The processing at large and the feature of a substrate processor of this operation are explained below. [of a gestalt]

[0028] The phosphoric acid solution PA is made to overflow from the upper bed of the side of the four way type in an inner lift 1 at the time of etching processing of Substrate W.
[0029] And the phosphoric acid solution PA overflowed from the inner lift 1 to the outside tub 2 is always discharged from the outside tub 2 by the circulating pump 4 through piping 3a, is fed by the heater 5 through piping 3b, and it is heated so that solution temperature may be maintained at 150-180 degrees C there. After the phosphoric acid solution PA which furthermore passed along the heater 5 being fed by the filter 6 through piping 3c and removing an impurity etc. there, it is returned to an inner lift 1 through 3d of piping, and is again used for etching processing of Substrate W. Thus, it is used in the substrate processor of the gestalt of this operation, circulating the phosphoric acid solution PA.
[0030] Moreover, as mentioned above, when solution temperature is maintained by 150-180 degrees C, the moisture contained in the interior tends to evaporate, and, thereby, as for the phosphoric acid solution PA, the concentration of the phosphoric acid solution PA tends to change. So, with this equipment, a suitable quantity of pure water PW is fed into the pure water impregnation nozzles 10a and 10b from the pure water tub 7 by an operator's measuring change of the concentration of the phosphoric acid solution PA accompanying evaporation of pure water PW with a measuring instrument etc., calculating the evaporation per unit time amount of pure water PW from that measured value, and setting up the flow rate of a metering pump 9 based on it.
[0031] And as shown in drawing 3 , the pure water PW supplied to the pure water impregnation nozzles 10a and 10b is discharged from each pure water exit cones Ha and Hb of two or more of the pure water impregnation nozzles 10a and 10b. The front face of the phosphoric acid solution PA overflow section 20a which is each upper bed of the sides 1a and 1c of an inner lift 1 by the inside of the inner lift [directly under] 1 of it, and near the 20b is reached, and it results in the gutters 30a and 30c of the outside tub 2, being mixed with the phosphoric acid solution PA, and flows into 30d of reservoir sections of the outside tub 2.
[0032] And the phosphoric acid solution PA stored by 30d of reservoir sections of the outside tub 2 is returned to an inner lift 1 as mentioned above via Piping 3a-3d, a circulating pump 4, a heater 5, and a filter 6, and is again used for etching processing of Substrate W.
[0033] Thus, in the substrate processor of the gestalt of this operation, it writes as the configuration which supplies pure water PW near the overflow sections 20a and 20b which are each upper bed of the sides 1a and 1c of the inner lift 1 which is the overflow section of the phosphoric acid solution PA, and pure water PW does not reach the interior of phosphoric acid solution PA in an inner lift 1. therefore, bumping of pure water PW -- not happening -- in addition -- and since the phosphoric acid solution PA and pure water PW are stirred in case the phosphoric acid solution PA carries out overflow to the outside tub 2 from an inner lift 1, and pure water PW is fully spread into processing liquid, pure water PW stops at a phosphoric acid solution PA front face by that cause and it does not evaporate in direct air from a phosphoric acid solution PA front face, there is little temperature lowering of the phosphoric acid solution PA.
[0034]
[3. modification] Although considered as the configuration which uses as phosphoric acid liquid liquid with the boiling point higher than the temperature of the processing liquid of two or more sorts of liquid which constitutes processing liquid, and uses a replenisher as pure water in the substrate processor of the gestalt of operation of this invention Two or more sorts of liquid which constitutes processing liquid is not what is limited to these. For example In order to constitute processing liquid combining sulfuric-acid liquid and hydrogen peroxide solution and to heat the temperature of processing liquid at hot about 130 degrees C from the boiling point of hydrogen peroxide solution in this case, it is the configuration which uses liquid with the boiling point higher than the temperature of processing liquid as sulfuric-acid liquid, and uses a replenisher as pure water.
[0035] Moreover, although the replenisher was made only into a pure water kind in the substrate processor of the gestalt of this operation, it is also possible to make two or more sorts of liquid with the boiling point below the temperature of processing liquid into a replenisher.

[0036] Moreover, although considered as the configuration which prepares two or more pure water exit cones in piping in a pure water impregnation nozzle at equal intervals in the substrate processor of the gestalt of this operation, you may not necessarily be regular intervals and a pure water exit cone can also be made into an unit. Furthermore, a means to supply pure water is good also as a configuration of it not being limited to this and preparing [for example,] slit-like puncturing.
[0037] Moreover, although considered as the configuration which an operator measures change of the concentration of a phosphoric acid solution with a measuring instrument etc., calculates the evaporation per unit time amount of pure water from that measured value, and sets up the amount of supplements of the pure water by the metering pump based on it in the substrate processor of the gestalt of this operation It is good also as a configuration which adjusts the amount of supplements of pure water by catching the concentration of a phosphoric acid solution serially by a sensor etc., and controlling the pump of a control-of-flow mold by the control unit based on the data.
[0038] Moreover, although the inner lift 1 made the same the height of the upper bed of the side of that four way type and considered as the configuration in which a phosphoric acid solution is full of an outside tub from a four way type in the substrate processor of the gestalt of this operation This invention is good also as a configuration of it necessarily not being restricted to the configuration which overflows from all the sides on all sides, making lower than two sides of the direction of X the overflow sections 20a and 20b which are each upper bed of the sides 1a and 1c of an inner lift 1, and overflowing only from Sides 1a and 1c.
[0039] furthermore, although considered as the configuration which prepares two pure water impregnation nozzles in the substrate processor of the gestalt of this operation, it is good also as the configuration which prepares one pure water impregnation nozzle only to the 1 side of an inner lift, and a configuration which the side of the four way type of an inner lift boils, respectively, and is received and prepared.
[0040] Moreover, although the pure water exit cones Ha and Hb of the pure water impregnation nozzles 10a and 10b are allotted near the upper part of the overflow sections 20a and 20b in the substrate processor of the gestalt of operation of this invention, said pure water exit cones Ha and Hb may be allotted to right above [of the overflow sections 20a and 20b].
[0041]
[Example] In addition, the pure water impregnation nozzle 10 is a product made from Teflon (brand name of the ethylene tetrafluoride polymer of Du Pont), and an inner lift 1 and the outside tub 2 are the products made from a quartz, and they consist of examples of this substrate processor so that the heat by the phosphoric acid solution and corrosion can be borne using the material with which other members are also equipped with thermal resistance, such as the above-mentioned Teflon and PTPF (polytetrafluoroethylene), and corrosion resistance.
[0042] Furthermore, capacity of the whole processing tub which combined the inner lift and the outside tub is made into 30-40l., and the set point of the flow rate of a metering pump consists of examples of this substrate processor possible [accommodation] between 0 - 200 cc/min to this. Thus, in this example, accommodation of the pure water amount of supply according to the evaporation of the moisture to the amount of a phosphoric acid solution can be performed.
[0043]
[Effect of the Invention] The inside of two or more sorts of liquid which constitutes processing liquid from invention of claim 1 and claim 2 as explained above, It writes as the configuration supplied [near / where the processing liquid of an inner lift overflows by making liquid with the boiling point below the temperature of processing liquid into a replenisher / right above / overflow section / or near the overflow section]. Since a replenisher does not reach the interior of the processing liquid in an inner lift, bumping of a replenisher does not happen. in addition -- and since processing liquid and a replenisher are stirred in case processing liquid carries out overflow to an outside tub from an inner lift, and a replenisher fully diffuses into processing liquid, and a replenisher stops at a processing liquid front face and does not evaporate in direct air from a processing liquid front face by that cause, there is little temperature lowering of processing liquid.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram of the appearance of the substrate processor of the gestalt of operation.
[Drawing 2] It is approximate account drawing of the substrate processor of the gestalt of operation.
[Drawing 3] It is the fragmentary sectional view of the substrate processor of the gestalt of operation.
[Description of Notations]
1 Inner Lift
2 Outside Tub
3a-3d Piping
4 Circulating Pump
5 Heater
7 Pure Water Tub
8a-8d Piping
9 Metering Pump
10a, 10b Pure water impregnation nozzle
30 Processing Tub
30a, 30b, 30c Gutter
Ha, Hb Pure water exit cone
20a, 20b Overflow section
1a, 1c The side of an inner lift
PA Phosphoric acid solution
PW Pure water
Ua, Ub Blow-off location
W Substrate

[Translation done.]